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T CHARACTERISTICS OF INTERNATIONAL COMMUNICATIONS OF THE UNITED STATES 2t

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I INTRODUCTION

Development of estimates of the impact of future commercial communications practices and characteristics upon the design of communication satellites requires some consideration of present conditions in the communications industry. This memorandum is written to briefly summarize some of the more important conditions. The types of electrical international traffic, the loads, and the geographical flow pattern are indicated. Selected features of international mail are discussed to show what possibility may exist for diversion of the load to satellite facsimile transmission. Other similar potential satellite loads are also briefly mentioned.

The observations here are based upon review of international communications from 1951 to 1958 for all traffic, and to 1959 in selected instances. No attempt has been made to reconcile small differences and vagaries in source data in this brief review.

II INTERNATIONAL COMMUNICATIONS TODAY

A. General Trends

International communication traffic, with few exceptions, has increased steadily year-by-year during the past decade. The causes for this are manifold--some obvious and some virtually unknown. Increased international trade and travel, expansion of United States business firms into foreign operations, and development of the United States as a world power are a few of the many reasons cited. In looking forward to future traffic demands perhaps some of these reasons will require detailed study to determine their degree of validity in causing increased communication.

Three principal means of international communication have been briefly reviewed to ascertain the historical trends of the industry; these are mail, telegraph, and telephone. Each has experienced increased traffic loads except for some categories of mail. In this case, though, air mail, which of all classes of mail is most analogous to electrical means of transmission in terms of the speed of delivery expected, has positive growth features. Surface mail, as will be shown later, has some slightly different characteristics. Comparison of the three methods of communication is perhaps best shown by comparing the number of pieces of air mail and the number of messages for electrical communication. Table 1 shows these traffic volumes since 1951.

The vast bulk of international communications is handled by mail. In 1958, for example, 90 pieces of air mail were handled for every telephone call and eight pieces for every telegraph message. These ratios have shifted in favor of the telephone, as comparison with the 1951 figures shows. Then about 125 pieces of air mail were handled for each telephone call but only six pieces for each telegraph message. Both air mail and telephone traffic are increasing at a higher annual rate than telegraph traffic.

Table 1

INTERNATIONAL MESSAGE COMMUNICATION TRAFFIC
FOR SELECTED MODES OF TRANSMISSION
(All units in thousands)

Year[2/]	Air Mail (Pieces)	Telegraph[1/*] (Messages)	Telephone[1/**] (Calls)
1951	127,421	20,884	1,152
1952	137,221	20,556	1,190
1953	149,035	20,639	1,320
1954	154,104	21,284	1,416
1955	158,330	22,343	1,504
1956	178,095	23,776	1,729
1957	189,031	24,143	2,031[3/]
1958	181,865	23,348	2,246[4/]

Source: U.S. Post Office Department, Annual Reports
Federal Communications Commission, Statistics of Communications Common Carriers.

1/ Excluding marine traffic.
2/ Fiscal years for air mail; calendar years for telegraph and telephone.
3/ Excluding 513,329 calls with Cuba.
4/ Excluding 556,217 calls with Cuba.

Table 2 shows these traffic trends in terms of the traffic flow in 1951, arbitrarily chosen as the base year. The growth rate of telephone traffic is obviously far greater than that of either mail or telegraph, with annual increases of about 20 percent from the previous year. Both air mail and telegraph loads experienced appreciable increases in 1957 over 1956, but then the rate of growth decreased. The telephone load underwent the same increase and continued this trend in subsequent years.

* See also Fig. 1, p. 25.

**See Fig. 2.

Table 2 *

RATIO OF ANNUAL INTERNATIONAL MESSAGE COMMUNICATION TRAFFIC WITH 1951=100

Year[1/]	Air Mail	Telegraph	Telephone
1951	100	100	100
1952	108	98	103
1953	117	99	114
1954	121	102	123
1955	124	107	130
1956	140	114	150
1957	149	116	176
1958	144	112	195

1/ Fiscal year for air mail; calendar year for telegraph and telephone.

Caution should be exercised at this time in using these traffic data, because they do not represent the totality of international traffic but only message traffic. Data pertaining to private use of circuits of both telephone and telegraph systems and Telex traffic are not included. Telex circuits are being installed and utilized at an increasing rate, and the number of leased telephone channels has been unofficially reported to be growing. Thus, prior to estimating future traffic volumes that possibly will be required in a satellite, additional investigation will be required in the aforementioned areas.

In Table 1 for 1957 and 1958, it was noted that telephone traffic does not include calls with Cuba. This is contrary to most reports of international traffic. Cuba was excluded because prior to 1957 Cuban traffic was not reported as international communications. Thus, in reviewing traffic trends an abrupt change in the reporting method will cause an erroneous impression of the trend, especially in view of the magnitude of Cuban traffic. Sufficient evidence is available to indicate that Cuba has had substantial volumes in the past. Thus, it is not clear why Cuban traffic was not reported separately before 1957. Apparently, Cuban traffic was formerly classified simply as toll calls and lumped with United States domestic traffic.

*See Fig. 3.

The reasons for the decreased volumes in the mid-50's are not understood, and, as will be discussed later, they are of only marginal interest here. These data are included to show the proportion of total traffic to each region and to illustrate the marked similarity in the traffic variations of each region. For example, when transatlantic traffic volumes decrease, a similar reduction is noted in both Latin America and transpacific loads. The transatlantic share of the total traffic has gradually decreased since 1951 but still claims more than 50 percent of the total load.

Telegraph message loads show characteristics similar to surface mail in terms of geographical distribution but somewhat different in their annual variations. Table 4 presents these loads for calendar years 1951-58. Again, transatlantic traffic accounts for about 50 percent of the total load; Latin America and transpacific traffic customarily claims one-third and one-sixth, respectively. The annual load variations within each group have some discrepancies.

Table 4*

INTERNATIONAL TELEGRAPH MESSAGE LOADS BETWEEN THE UNITED STATES AND MAJOR WORLD REGIONS 1951-58
(Thousands of messages)

Calendar Year	Transatlantic	Latin America	Transpacific
1951	9,830	6,088	3,638
1952	9,841	6,138	3,524
1953	9,932	6,272	3,367
1954	10,288	6,535	3,333
1955	11,046	6,715	3,996
1956	11,752	7,224	3,712
1957	11,920	7,599	3,631
1958	11,612	7,355	3,431

Source: Federal Communications Commission, Statistics of Communications Common Carriers (for year indicated)

All show a somewhat uniform upward trend with a significant increase in 1956 followed by a drop in 1958.

Somewhat similar patterns also apply to telephone traffic, as shown in Table 5.

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*See Fig. 1.

The implication of these traffic volumes with respect to satellite systems in general would seem to be that a demand for more transmission capacity can be expected, and that possibly it could be satisfied by satellites. Numerous political, economic, and technical questions will require examination before conclusive evidence can be assembled indicating what future demand should be met by either satellites or existing conventional means. These considerations must also take into account loads on satellites that may materialize solely because satellites will offer services not heretofore available at economic rates by existing techniques. This question involves estimating demand for services that do not now exist, such as high bit rate transmission and the sending of air mail by facsimile methods.

B. Geographical Pattern of Traffic Flow

International communication traffic of the United States customarily is divided into three major geographical groups: transatlantic, including Europe, Africa, and the Near East; Latin America, including the West Indies, Central and South America; and transpacific, which covers Asia, Oceania, and Australia. The general traffic trends to each of these regions have the same characteristics for each mode of communication. Transatlantic traffic typically accounts for about one half of the total load for each mode, but Latin America and transpacific shares of traffic vary with the method.

Table 3 presents the gross geographical pattern for surface mail of United States and foreign origin dispatched by sea to foreign destinations that is handled by the United States Post Office Department. These volumes exclude United States military mail. Unfortunately no equivalent data are presently available for air mail.

Table 3

SURFACE MAIL OF UNITED STATES AND FOREIGN ORIGIN DISPATCHED TO FOREIGN DESTINATIONS HANDLED BY THE UNITED STATES POST OFFICE DEPARTMENT
(Thousands of pounds)

Fiscal Year	Transatlantic	Latin America	Transpacific
1951	193,729	84,666	42,488
1952	180,210	68,554	75,730
1953	158,078	73,478	23,417
1954	115,426	70,869	22,030
1955	95,460	68,748	21,656
1956	97,217	70,375	23,368
1957	108,927	72,687	23,564
1958	111,826	77,929	27,311

Source: U.S. Post Office Department, Annual Reports for years indicated.

Table 5*

INTERNATIONAL TELEPHONE LOADS BETWEEN THE UNITED STATES AND MAJOR WORLD REGIONS 1951-1958
(Number of calls)

Calendar Year	Transatlantic	Latin America	Transpacific
1951	323,772	251,511	296,009
1952	307,501	268,582	343,851
1953	332,717	298,381	352,502
1954	356,829	341,187	352,876
1955	426,738	412,904	354,143
1956	524,275	479,743	389,836
1957	698,727	544,034 1/	422,094
1958	772,493	600,241 1/	498,462

Source: Federal Communications Commission, Statistics of Communication Common Carriers. (for years indicated)

1/ Excluding Cuba.

As in the previous two modes of communication, the greatest share of the load is transatlantic; however, for telephone this traffic accounts for only about 33 to 40 percent of the total. The annual telephone load growth for the three regions has similar characteristics throughout most of the time period. During 1956 and 1957 the transatlantic traffic load increased markedly, but in 1958 it increased no more than did traffic to Latin America and the Orient. As in the case of Table 1, the traffic to Cuba has not been included in Table 4 for reasons previously cited.

The traffic data shown in Tables 4 and 5 do not identically total to the traffic shown in Table 1. This discrepancy is caused by the fact that a small percentage of the total load shown in Table 1 either cannot be identified with respect to its origin and destination or is traffic handled by United States carriers that had neither its origin nor its destination in the United States. All traffic loads shown include both that which is originated in and that which is destined for the United States. As a general rule of thumb it can

*See Fig. 2.

be said that incoming traffic is equal to the outgoing load for total regional loads, although this generalization does not apply to traffic to individual nations.

While the growth within each mode of communication has somewhat similar characteristics to all regions, there is considerably less similarity among the different modes to the same region. Table 6 illustrates the load characteristics for international electrical traffic in terms of its relationship to 1951, arbitrarily chosen as the base year.

Table 6

INDEX OF UNITED STATES INTERNATIONAL TELEGRAPH AND TELEPHONE MESSAGE TRAFFIC WITH VARIOUS WORLD AREAS
1951=100

Calendar Year	Transatlantic		Latin America		Transpacific	
	Telephone	Telegraph	Telephone[1/]	Telegraph	Telephone	Telegraph
1951	100	100	100	100	100	100
1952	94	100	107	101	116	97
1953	101	101	119	103	119	93
1954	108	105	136	108	119	92
1955	130	113	164	110	120	96
1956	160	120	192	119	132	102
1957	212	122	213	125	142	100
1958	235	118	240	121	169	94

1/ Excluding Cuba.

It is quite apparent that to all regions the rate of increase of telephone traffic is substantially greater than that of telegraph. In fact, the trend of telegraph to the Pacific shows anything but a growth characteristic. Telephone loads across the Atlantic and to Latin America have grown at approximately the same rate, with the number of calls in 1958 more than double that of 1951. Transpacific traffic has had an over-all lower rate of growth but the increased rate in the past several years suggests that its trend may increase to that of transatlantic and Latin America.

The reasons for significantly lower trends of telegraph loads are not readily apparent. Overnight air mail delivery by regularly scheduled high-speed aircraft has been alleged to be a serious threat to electrically transmitted record communication traffic. This

argument may have some validity today, and for the past year or two, since more and more jet aircraft have been serving an ever increasing number of points with frequent flights. In the early 1950's, though, this argument did not apply. Compared with today, international air mail was in its infancy; flights were infrequent and long and a small number of major world cities were served.

The degree to which traffic has been diverted from telegraph to telephone can not be determined. While telephone growth has overwhelmingly surpassed telegraph growth, there are still about 20 telegraph messages for each telephone call. For every telegraph message lost there has not been one more telephone call.

A partial explanation for the relatively slow rate of growth of telegraph message traffic may be in the growing popularity of leased channel and Telex service. Revenue from these services accounted for 2.7 percent of the total revenue in fiscal 1950, while for fiscal 1959 this service developed 14.7 percent of all revenue. The load carried by these circuits might have been transmitted as message traffic had these services not existed.

A determination of traffic flow patterns for geographical units smaller than the three used here will produce results with some degree of error, especially for telephone traffic. Traffic is reported in terms of the origin and the first point of receipt. Thus, if direct service is not available to a given point and calls must be transferred to other systems at an intermediate exchange, a call is listed as destined for the intermediate exchange rather than the ultimate point. For example, a call from New York to Syria must be switched at Rome from AT&T to Italcable. Thus, the call is logged as New York-Rome rather than New York-Syria.

These errors of reporting do not appear to be as significant for telegraph traffic. This may be because the initial message filed is a permanent record and bears all necessary address data thereby allowing more accurate analysis. The more transitory nature of telephone traffic makes it less amenable to elaborate record maintenance. Moreover, telegraph companies serve a slightly larger number of foreign points with direct circuits than do telephone circuits. In 1958, for example, the FCC reported telephone traffic with 64 world points while telegraph messages were listed for 107.

These difficulties of reporting notwithstanding, a few summary observations of the magnitude of traffic flow between the United States and selected foreign points are of interest. Typical load distributions are shown in Table 7 for all nations having 10,000 or more telephone calls with the United States in 1958. Comparative telephone data are shown for 1955 as well as telegraph message traffic for the same nations and years.

Three European nations--United Kingdom, Germany, and France--accounted for approximately two-thirds of transatlantic telephone traffic and one-half the telegraph traffic for both 1958 and 1955.

Generally, nations with heavy telephone traffic have a corresponding volume in telegraph, except for the Netherlands, Spain, and Bermuda. Both the former have comparatively high telegraph loads, while Bermuda has almost an extraordinary telephone load and very little telegraph traffic.

Latin American telephone loads, except for the Bahamas and Puerto Rico, are relatively evenly distributed. (Cuba, as previously cited, is removed.) Telephone and telegraph loads have similar relationships with each other when compared to world loads except for Puerto Rico and the Bahamas. They are in the same situation as Bermuda.

Over one-half of the transpacific telephone traffic flows between the United States and Hawaii, with Japan a poor second. It might be noted also that the proportion of world traffic to Japan in 1958 is less than one-half that of 1955. Traffic dropped from 100,404 in 1955 to 78,914 in 1958, practically the only traffic decrease reported by any nation. Telegraph message load distribution remained essentially constant between the two reporting periods. Here again, though, load drop to Japan was almost one percent.

Table 7

1958 INTERNATIONAL MESSAGE TRAFFIC TO NATIONS WITH MORE THAN 10,000 TELEPHONE MESSAGES
(expressed as a percentage of world loads)
(compared with 1955)

Nation or Region	1958 Telephone	1958 Telegraph[1/]	1955 Telephone	1955 Telegraph[1/]
Transatlantic	39.7	52.1	36.6	51.7
Austria	0.6	0.4	0.6*	0.4
Belgium	1.1	1.8	0.8*	1.9
Bermuda	2.2	0.4	2.6	0.4
Denmark	0.6	0.7	0.4*	0.6
France	4.8	5.0	5.0	5.4
Germany	8.0	5.6	9.1	5.5
Italy	1.9	3.8	1.8	3.4
Netherlands	1.4	3.2	1.1	3.5
Spain	1.0	1.1	1.2	1.0
Sweden	1.0	1.3	0.4*	1.3
Switzerland	2.3	3.2	2.4	3.1
United Kingdom	14.3	15.4	8.9	16.2
Latin America[2/]	32.9	32.6	33.2	31.5
Argentina	1.9	2.5	2.4	2.4
Bahamas	3.5	0.5	3.5	0.4
Brazil	1.7	3.7	2.3	3.8
Columbia	1.7	1.5	2.1	2.2
Dominican Republic	1.3	0.7	1.2	0.6
Guatemala	0.7	0.7	0.9	0.6
Jamaica	1.4	0.5	1.2	0.4
Nicaragua	0.6	0.3	0.7*	0.4
Panama	1.7	0.5	2.3	0.5
Peru	0.7	0.9	0.9	0.9
Puerto Rico	9.4	2.3	9.0	1.9
Venezula	2.4	4.4	2.3	3.4
Transpacific	27.4	15.2	30.2	16.0
Australia	0.8	1.3	1.0	1.2
Guam	0.6	0.2	1.1	0.2
Hawaii	18.8	1.8	15.1	1.8
Japan	4.2	4.1	8.5	4.9
Korea	0.6	0.5	0.6*	0.4
Okinawa	0.8	0.2	1.0	0.2
Philippines	1.2	1.6	1.3	1.5

*Less than 10,000 calls in 1955.

1/ Regional totals do not add to 100 percent because of a small number of unclassified messages.

2/ Excluding Cuba.

C. Message Types

International telephone traffic is reported simply as the number of calls. Information presently available does not contain indications of the nature of these calls, such as government, press, or commercial. In the absence of these data, the analysis of the traffic can be carried out only in a gross manner.

On the other hand, telegraph traffic is reported in somewhat more detail. Some indication is available as to the nature of the traffic as well as the users. Consequently, the influence of this traffic on a satellite may be slightly easier to outline. International message traffic is divided into five major categories, with "Public Messages" typically accounting for more than 85 percent of the total. The Public Message category is in turn divided into four groups of which two account for more than 90 percent of the category or about 85 percent of the total telegraph message load. These categories and their typical share of traffic are summarized in Table 8.

Table 8*

TYPICAL INTERNATIONAL MESSAGE TRAFFIC LOAD
DIVISIONS EXPRESSED AS A PERCENTAGE OF TOTAL LOAD

Public Messages	
Full Rate-Urgent	0.4%
Full Rate-Ordinary	49.3
Letter	36.0
Greeting	0.7
Sub-total	86.4%
Government Messages	2.2%
Press Messages	1.9
Other Commuted Rate Messages	0.1
Miscellaneous Messages	9.4
Total	100.0%

It is apparent from Table 8 that the bulk of message traffic does not carry a critical time priority. That is, only full rate-urgent, press, and probably some government traffic would be expected to require expeditious handling; these account for about five percent of the total volume. Most of the remaining load is generally of the type that is delayed and transmitted somewhat at the discretion of the carrier. This message class would place less stringent performance requirements on a satellite system than the messages with high time priorities. Load factors are more under the control of the carrier and many satellite design parameters--bandwidth, orbit altitude, and speed--can have wide latitude and still provide service suitable to demand.

*See Fig. 4.

D. United States International Communication Companies

Presently there are nine principal[1/] United States international telegraph common carriers and four Class A[2/] United States international telephone common carriers. For all practical purposes these 13 companies carry all international traffic that is either originated in or destined for the United States. These companies own and have full control over the circuit terminals located in the United States and its possessions. On the other hand, most of the foreign terminals are owned not by these organizations but by the communication agencies in the foreign nations. Therefore, while these 13 companies completely dominate United States' international electrical communications, the operation of the systems is not wholly under their control.

International telegraph traffic into and out of the United States is handled today by nine companies of which five account for about 93 percent of the total revenue. Through intercorporate relationships two companies receive 75 percent of the total revenue with a third accounting for about 18 percent. These nine companies are shown below along with their corporate relationships and their share of revenue for the 1958 calendar year. (See Fig. 6.)

American Cable & Radio Corporation	
All American Cable & Radio, Inc.	18.3%
The Commercial Cable Company	8.5
Mackay Radio & Telegraph Company	14.2
RCA Communications, Inc.	33.2
Western Union Telegraph Company[3/]	18.7
Tropical Radio Telegraph, Inc.	3.7
Press Wireless, Inc.	2.3
Globe Wireless Limited	1.1
United States-Liberia Radio Corporation	less than 0.01

The relative position of the companies as shown above has remained substantially the same for about the past decade. In 1951 the Commercial Pacific Cable Company dissolved because their trans-Pacific cables after years of unreliable operation and high maintenance costs became completely inoperative. In 1951 their gross revenue was $540,115, less than one percent of the industry total.

Prior to 1957 the Radio Marine Corporation of America and RCA Communications, Inc. were wholly owned subsidiaries of the Radio Corporation of America. On August 31, 1956 the Radio Marine Corporation of America was dissolved; its maritime communication operations being transferred to RCA Communications, Inc. and the remaining activities of Radio Marine Corporation of America being absorbed by the parent

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1/ Companies with annual operating revenues exceeding $50,000.
2/ Companies with annual operating revenues exceeding $250,000.
3/ International operating revenues only.

organization. RCA Communications, Inc. revenues were about 10 times those of Radio Marine Corporation of America prior to the change.

The latest corporate change within the industry was the purchase of Globe Wireless Limited by American Cable & Radio Corporation in April 1960 for 100,000 shares of AC&R stock[1/]. This acquisition does not significantly change the competitive position of AC&R in relation to the other carriers. Presumably Globe Wireless Limited will be operated in the same manner as the other three companies wholly owned by AC&R. It might be noted in passing that the International Telephone and Telegraph Corporation holds 58.17 percent of the outstanding stock of AC&R with the remainder being publicly held.

The future of the Western Union Telegraph Company continues to be uncertain. It will be recalled that in 1943 when Western Union's acquisition of Postal Telegraph was approved by the Federal Communication Commission the Commission directed Western Union to divest itself of all international communication facilities. The company still is trying to carry out the order. The major portion of the plant under consideration includes five cables owned by the company and five cables leased until 2010 from The Anglo-American Telegraph Company, Ltd. All these cables carry North American-Europe traffic. Presumably, the divestment order also includes the cable to Latin America as well as the cable complex from the primary cable heads in Newfoundland to Nova Scotia and the United States. A number of dates have been set by the FCC at which time Western Union must have either sold the cable plant or at least be well into the process of selling it. However, when the date of action is reached and no significant progress has occurred, little seems to happen except that a new divestment date is established. This is not intended to imply that Western Union has not made some effort to sell their plant. The problem seems to be that no interested purchaser can arrange the necessary financing.

The latest plan for divestment announced on September 15, 1960 includes an agreement between Western Union and American Securities Corporation which would establish a new cable operating company. The new company would issue senior securities, subordinated debentures, and various grades of stock as an underwritten offering. In the total financing plan Western Union is earmarked for the purchase of 250,000 shares of a so-called Class B stock which has a non-voting status. A final major provision is included which specifies that if the new cable company is merged with another international common carrier the Class B holding of Western Union will be redeemed.[2/]

1/ Moody's Public Utility Manual (1960).
2/ The Western Union Telegraph Company, "Report to Share Owners," November 4, 1960.

These industry questions as well as others which are not discussed here are of no little concern in the development of satellite communication systems. As will be shown later, the American Telephone and Telegraph Company operates all international radio-telephone and cable circuit terminals in the continental United States as well as the long lines within the United States. This is in distinct contrast to the international telegraph industry where the market is shared by nine companies. Only one of these nine--Western Union--operates within the United States, and, as indicated previously, the ultimate position of Western Union will be that of strictly domestic operation. Competition among international telegraph carriers has existed practically since the first cable; moreover, historically it has been the policy of the FCC and Congress to forbid any merger or "teamwork" of international telegraph carriers. This philosophy also prevailed within the United States until March 1943, when the Federal Communications Act was amended to permit merger of Western Union and Postal Telegraph.

Numerous committees have been formed and much testimony has been given concerning this policy since the early '40's. In nearly every case the conclusions and recommendations have been to permit merger or joint operation of one type or another. One very common argument advanced is that nearly every nation in the world has a single communication agency and in most cases it is a state monopoly. The small United States telegraph companies cannot compete with the large state monopolies and consequently their positions are somewhat difficult to maintain. Amalgamation of the companies into one system would place the telegraph industry in a far stronger position.

If there were a single telegraph operating company, the FCC, it is argued, could assume more of a role of a "sponsor" of the telegraph industry in negotiations with other nations. This would be especially helpful, for example, in negotiations to secure cable landing rights and land for radio stations, to develop toll division procedures, and to support generally the position of the United States industry.

Under present conditions the FCC acts as a "disinterested" regulatory agency. Each telegraph company must carry out all these negotiations alone; after reaching accord with foreign interests, the entire agreement must be submitted to FCC for review and approval. This process usually involves public hearings and protracted analyses to determine if the competing telegraph companies will be injured. If the agreement is found to be defective for any one of a variety of reasons, the telegraph company must reopen negotiations with the foreign agencies in an effort to reach a different agreement that is mutually satisfactory to the two parties, to the FCC, and to the telegraph industry. This requirement, it is claimed, is almost impossible to reach; the result is that the United States international telegraph industry has stagnated while foreign communication industries have advanced at the expense of the United States.

In addition to these arguments there is the host of problems always associated with public utilities operating in a highly competitive situation.

International voice communication does not seem to be afflicted by these complex problems. Quite probably one of the main reasons for this is the matter of time. The international telegraph industry is practically 100 years old. In its early history there was very little thought of regulation and the FCC did not exist. However, international voice communication on a large scale is not more than 30 years old.

Voice networks were started after the concept of regulation had been more or less accepted and the FCC had been created by Congress. Presumably, too, all interested parties had profited from the experience of the telegraph industry and many pitfalls were avoided. Thus, today rather than nine companies, there is one--American Telephone and Telegraph--which controls all international voice circuit terminals in the United States, although in past years some telegraph companies have applied to the FCC without success to establish regular telephone service.

There are three other United States Class A telephone carriers carrying international traffic but they are outside the continental United States and are miniscule in comparison with AT&T. Their combined income from international traffic is about 10 percent of the AT&T international revenue and their combined total revenue runs about 0.3 percent of AT&T's. These companies are: the Cuban American Telephone Company, jointly owned by AT&T and International Telephone and Telegraph Corp.; the Hawaiian Telephone Company, operating in Hawaii; and the Radio Corporation of Puerto Rico, wholly owned by the International Telephone and Telegraph Corporation.

In summary, the problems of the international telephone and telegraph industries are quite different. Telephone for all practical purposes is wholly controlled by a single company, while telegraph is divided among nine companies. The problems of regulation and administration of the two are quite different; moreover, the future development of the industries conceivably could be quite different. Telephone has no competition; that is, voice is voice and there doesn't seem to be anything around to replace it, yet. Telegraph, or record communication, faces competition from numerous points, such as air mail and facsimile. Voice communication, also, in a sense, is a competitor, as its quality, and other characteristics are improving constantly while telegraph development has virtually stopped. There appear to have existed two national policies in regard to international communications. Namely, competition must exist among international telegraph carriers, while a single international telephone carrier has operated without competition.

There is no intention here to explore the labyrinthian policies of the FCC and Congress or to develop arguments that these policies are right or wrong. The purpose here is to briefly review and call attention to some of the more pertinent parameters of international communications. Any analysis of the impact of commerical communication practices on satellite systems should be made with these conditions in mind.

III FUTURE INTERNATIONAL COMMUNICATIONS

The traffic that will be generated by a commercial communication satellite because of its superior engineering properties and perhaps lower cost is of as much interest as the growth of existing forms of communication. Estimating the potential of such traffic requires both considerably more speculation than for that of existing facilities and examination of many peripheral areas not immediately related to communication. Several of the prominent potential loads are discussed briefly below.

A. Mail

The use of satellite systems for facsimile transmission of mail has been discussed on numerous occasions. Well publicized tests of such transmissions have been held within the United States over existing commercial facilities. Future use of this technique depends upon a great number of factors varying all the way from social acceptance of the end product to the more ponderable technical and economic feasibility of such a scheme. With respect to the economic feasibility of facsimile transmission, a question of major importance is the potential load for the system. At this time, no dependable estimate of potential loads can be derived, although some general indications can be shown.

Table 10 shows some characteristics of the United States international air mail traffic since 1946. As indicated previously, the trend in the number of pieces of air mail is clearly on the upswing, and, as can be seen in Table 10, surface mail has a corresponding trend. Moreover, the weight of air mail has the same history; oddly, though, the weight of surface mail has just the opposite trend. Since 1948, for example, the number of pieces of surface mail has gone up about 20 percent, but the weight has decreased by almost a factor of three. It is not clear whether there has been an actual decrease in the weight of overseas postal-type items or simply a reclassification of items from mail to freight and other categories.

Table 10

SELECTED CHARACTERISTICS OF INTERNATIONAL MAIL

Fiscal Year	No. of Pieces-thousands			Weight--thousand of pounds		
	Air	Surface	Total	Air	Surface	Total
1946	672,425	229,882	902,307	16,665	194,766	211,431
1947	94,089	272,009	366,098	3,206	365,626	368,832
1948	120,779	288,506	409,285	4,181	472,102	476,283
1949	120,163	295,792	415,955	5,005	414,983	419,988
1950	121,921	295,391	417,312	5,430	339,537	344,967
1951	127,421	301,460	428,881	5,643	259,473	265,116
1952	137,221	311,944	449,215	6,111	246,359	252,470
1953	149,035	336,462	485,497	6,603	235,902	242,505
1954	154,104	348,231	502,335	6,863	193,606	200,469
1955	158,330	353,505	511,835	7,138	169,572	176,710
1956	178,095	355,864	533,959	7,908	162,947	170,855
1957	189,081	369,603	558,684	8,623	169,963	178,586
1958	181,865	352,618	534,483	8,596	165,317	173,913

Source: U.S. Post Office Department, Annual Reports (years indicated).

A general indication of possible satellite loads can be derived from the data of Table 10. The average weight per piece of mail for both air and surface transit is shown in Table 11. In the past the weight per piece of air mail has been slightly less than three-fourths of an ounce. This average weight is to be expected because from 1951 through 1958 about two-thirds of the weight of international air mail has consisted of "letter mail," while the categories of "parcel post" and "other articles" each have accounted for one-sixth of the weight.

Table 11

AVERAGE WEIGHT PER PIECE OF INTERNATIONAL MAIL

Fiscal Year	Air		Surface	
	(lbs)	(oz)	(lbs)	(oz)
1946	0.025	0.40	0.85	13.6
1947	0.034	0.54	1.34	21.5
1948	0.035	0.56	1.64	26.2
1949	0.042	0.67	1.40	22.4
1950	0.045	0.72	1.15	18.4
1951	0.044	0.70	0.86	13.8
1952	0.044	0.70	0.79	12.6
1953	0.044	0.70	0.70	11.2
1954	0.045	0.72	0.55	8.8
1955	0.045	0.72	0.47	7.5
1956	0.044	0.70	0.46	7.4
1957	0.045	0.72	0.46	7.4
1958	0.047	0.75	0.47	7.5

It is reasonable to expect that a substantial portion of this load consists of printed and/or written material that is suitable for facsimile transmission. Business and personal letters, invoices, bills of lading, and related communications quite probably make up a substantial portion of the load. Some portion of this class of items will not be amenable to facsimile techniques because, for example, the items may carry notary seals and related authenticating symbols, or they may be negotiable instruments of a variety of types which cannot be reproduced. Moreover, some portion of this load classification will consist of items in color for which facsimile transmission may not be suitable. Nevertheless, it is reasonable to expect that a large portion of international air mail traffic is of the type that could be handled by a satellite facsimile system.

The characteristics of surface mail are, of course, quite different. While the weight per piece has steadily decreased, it is still ten times that of air mail. Moreover, the distribution among the types of mail is in no way similar to air mail. Here letters and similar material make up only about 2 percent of the total weight while "printed matter" and "parcel post" account for 52 and 46 percent, respectively. However, it is well to note that even though the portion of letters in surface mail is very small, the fact that total surface

mail weight in 1958 was 20 times that in air mail (80 times air mail in 1951) means that there may be a potentially large facsimile load here as well.

Diversion of surface mail to facsimile transmission probably could not be expected to materialize to nearly the extent that could be expected for air mail. The category of "letters" is broad and undoubtedly contains numerous pieces other than letters. Moreover, the matter of rates for transmission would play a far greater role than for air mail. For example, the cost of surface mail to Europe is about one-fourth the cost of air mail for the first ounce, and to the Orient approximately one-sixth of the air mail rate. The cost for each additional ounce of surface mail to Europe is one-sixteenth and to the Orient one-twenty-fourth, of the air mail rate. Thus, while it may be quite feasible to develop satellite facsimile systems economically attractive to some air mail users, creating a competitive situation against surface mail clearly is a far greater challenge. The continuing growth trend of air mail does represent an increasing potential for satellite facsimile transmission of this traffic.

B. Meteorological Data

The increase in international air traffic, the constant need for improvement of ship operation, and the growing techniques of weather forecasting and analysis have created large demands on communication systems for transmission of meteorological information. Today most ground-to-ground meteorological information is transmitted by teletype with some voice and limited intra-continental facsimile. As far as can be determined, inter-continental traffic is entirely by teletype. Meteorological information transmission to aircraft in flight is by voice, though some consideration has been given to teletype and facsimile.

Probably of greatest importance for at least the early satellite systems is the transmission of international ground-to-ground meteorological data. Developing estimates of such loads will first require consideration of the operating modes of the "weather community." The next step is a translation of these findings into requirements for communication equipment and techniques. This analysis has not been carried out for this memorandum. However, certain weather load requirements stated by the International Civil Aviation Organization are summarized below to provide an example of one type of traffic load and to suggest a point of departure for additional analysis.

The ICAO met jointly with the World Meteorological Organization in 1958 to study problems of organization and communication in the collection and distribution of weather data for aircraft operation. The meeting was directed to the problems in Europe and the Mediterranean Basin, but some consideration was given to ways of incorporating North American and other northern hemisphere weather data into the European system. The major findings are briefly summarized below.

Weather data exchanged between North America and Europe is handled by one radio teletype circuit routed from New York to Paris via Santa Maria. Future traffic is foreseen to be of such magnitude that unacceptable delays may occur in this circuit. Therefore, a special working group of the WMO was requested to consider ways of increasing traffic capacity, such as utilizing cable and forward-scatter systems for the excess traffic. The results of this analysis are not known, though they were to be submitted to the President of ICAO Region VI not later than January 1, 1959.

The weather data network for the ICAO in the Northern Hemisphere consists of over 1,800 basic stations plus an unknown number of secondary and auxiliary stations, including aircraft and ships at sea. No information is reported for the Southern Hemisphere. The general operational plan consists of establishing a few key points in each geographical area which gather information from the observation stations, assemble and summarize the data, and then distribute the findings to all subscribers. The key points of the system that has been tentatively planned include Frankfurt and Paris in Europe, Moscow for the USSR, and Tokyo and New Delhi in the Far East. It appears that New York is the key point in the United States if not for all North America.

International traffic flowing into Paris has been estimated by the ICAO on a group-per-day basis as shown in Table 12. It is not known if these estimates materialized nor if the communication circuits exist today as suggested in 1958. The traffic estimates were based upon the assumption that four surface weather charts for the Northern Hemisphere were to be prepared daily. This assumption may not have been realized.

In any event it is quite obvious that weather traffic for commercial use (not to mention military) is very heavy; furthermore, as commercial aviation expands to more numerous operations in the Southern Hemisphere, the load undoubtedly will grow further. Satellite facsimile transmission would appear to be of great use in weather communication. Synoptic and other maps could be plotted once rather than duplicated on each continent. Moreover, observations from the numerous weather stations would need to be transmitted to a single point for use rather than be sent first to Paris, then to New York, and then perhaps to Tokyo. If weather traffic in other areas of the world is anywhere near that of Europe, satellite systems should indeed prove of great value not only for facsimile but for telephone and telegraph as well.

Table 12

ESTIMATED DAILY TRAFFIC VOLUMES AT PARIS
REQUIRED FOR INTERNATIONAL CIVIL AVIATION

Area	Traffic Groups per Day
Europe, Middle East, North Africa	26,100[1/]
Moscow and New Delhi	12,100
Africa, other than North	3,200
Ships	3,000
North America	50,300
Tokyo[2/]	4,000
Total	98,700

1/ An additional 46,600 groups of European data handled by Frankfurt and 3,400 by Dunstable.

2/ Possibly via New York.

Source: International Civil Aviation Organization, "Joint ICAO WMO Meteorological Telecommunication Meeting, Europe, 1958," Document 7881, MET-COM/1, Geneva, 24 February-8 March 1958.

C. Television

No definitive data on international television can be reported at this time. Perhaps of all new international communication modes made possible by satellites, the prediction of television loads is the most difficult and subjective. Several aspects of the problem can be examined in a somewhat quantitative manner, however, to at least provide a general framework in which to weigh the qualitative questions. These are enumerated briefly below.

First, the question of real-time versus delayed transmission is of some importance because of the time differences in the world, real time transmission appears to be quite limited except for South America. Unless the foreign event is of extreme interest it is difficult to visualize commercially valuable television audiences viewing real time programs from, say, India or even Europe. In the case of delayed transmission, the questions of cost and operating procedures are of interest. Here, the costs of satellite transmission versus aircraft transport can be reviewed. For example, if programs from Europe transmitted by satellite must be delayed until an appropriate viewing time, satellite transmission will be of marginal utility unless the costs are significantly lower than air transport. Transmission by

satellite, however, would allow increased time for editorial and related manipulation of the television tape prior to public broadcast.

Second, the distribution facilities in foreign nations required to carry television traffic to/from the satellite ground station could be examined. For example, if the location is Paris or London no serious difficulties would be anticipated in acquiring circuits to the ground station if it were in their environs. On the other hand, transmission in the provinces or perhaps Africa may be quite a different problem due to lack of well developed networks. Thus again, tape transport by aircraft may be a serious competitor. Many regions of the world have little or no communication facilities, and few or no television broadcast stations or distribution networks.

Third, numerous nations today maintain rather restrictive regulations regarding the import of television film from the United States. Conceivably these regulations could also apply to television transmitted by satellite. Any market which may exist could be considerably limited by such import regulations, thereby creating lower satellite loads than otherwise might have been possible. It is not clear if regulations apply to television export from foreign nations to the United States, which also may limit television loads.

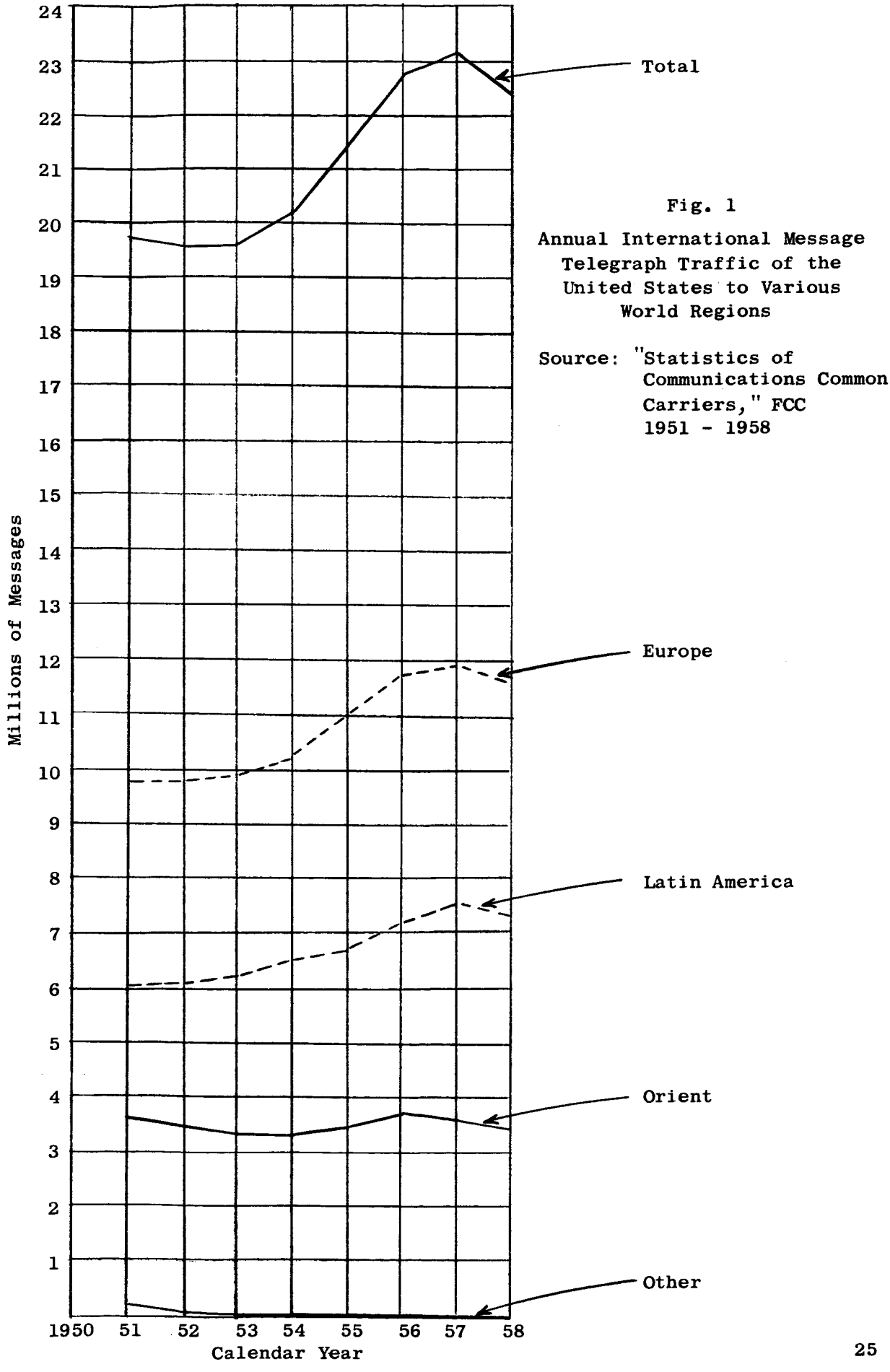


Fig. 1

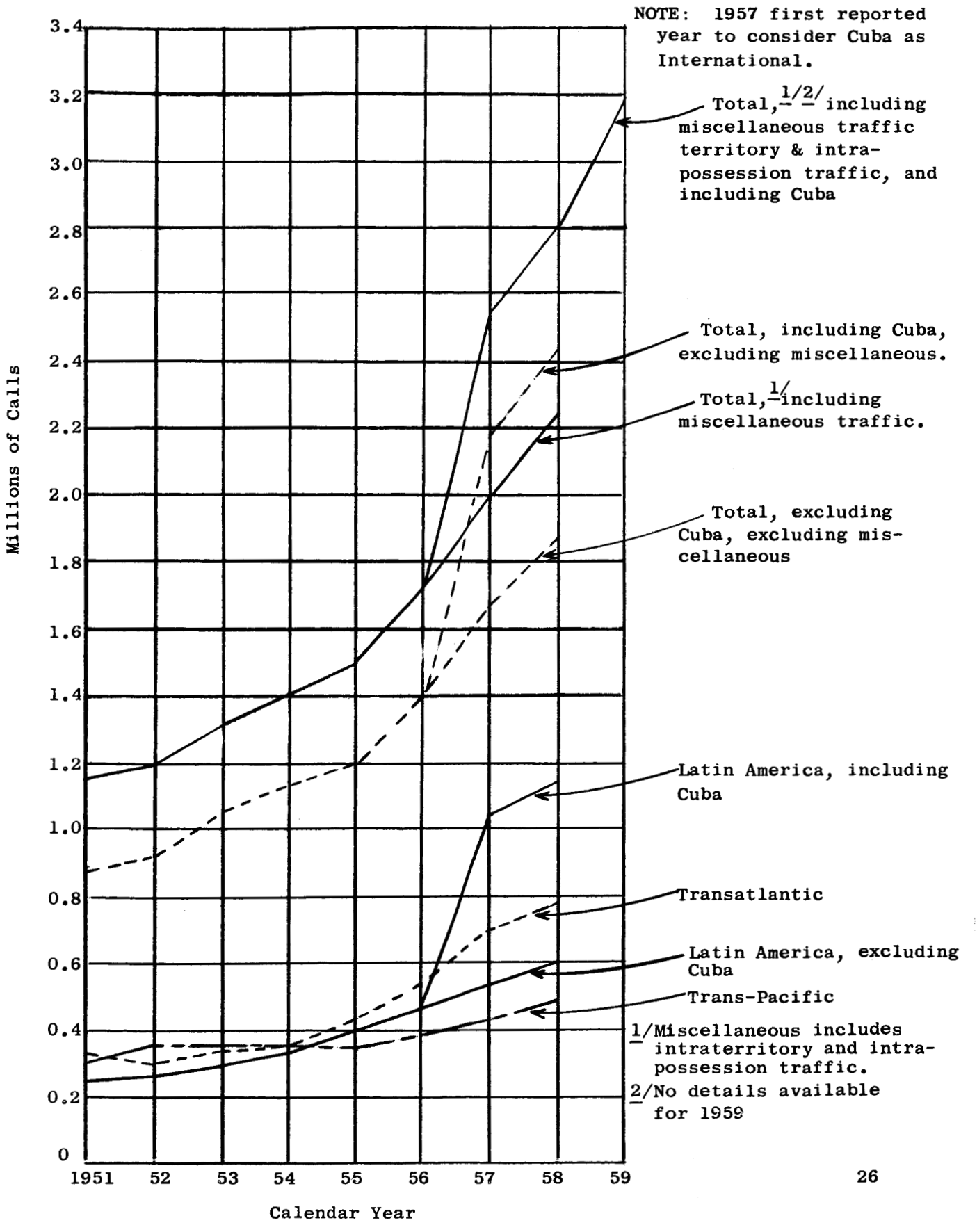
Annual International Message Telegraph Traffic of the United States to Various World Regions

Source: "Statistics of Communications Common Carriers," FCC 1951 - 1958

Fig. 2

Annual International Message Telephone Traffic of the United States

Source: "Statistics of Communications Common Carriers," FCC, 1951-1958



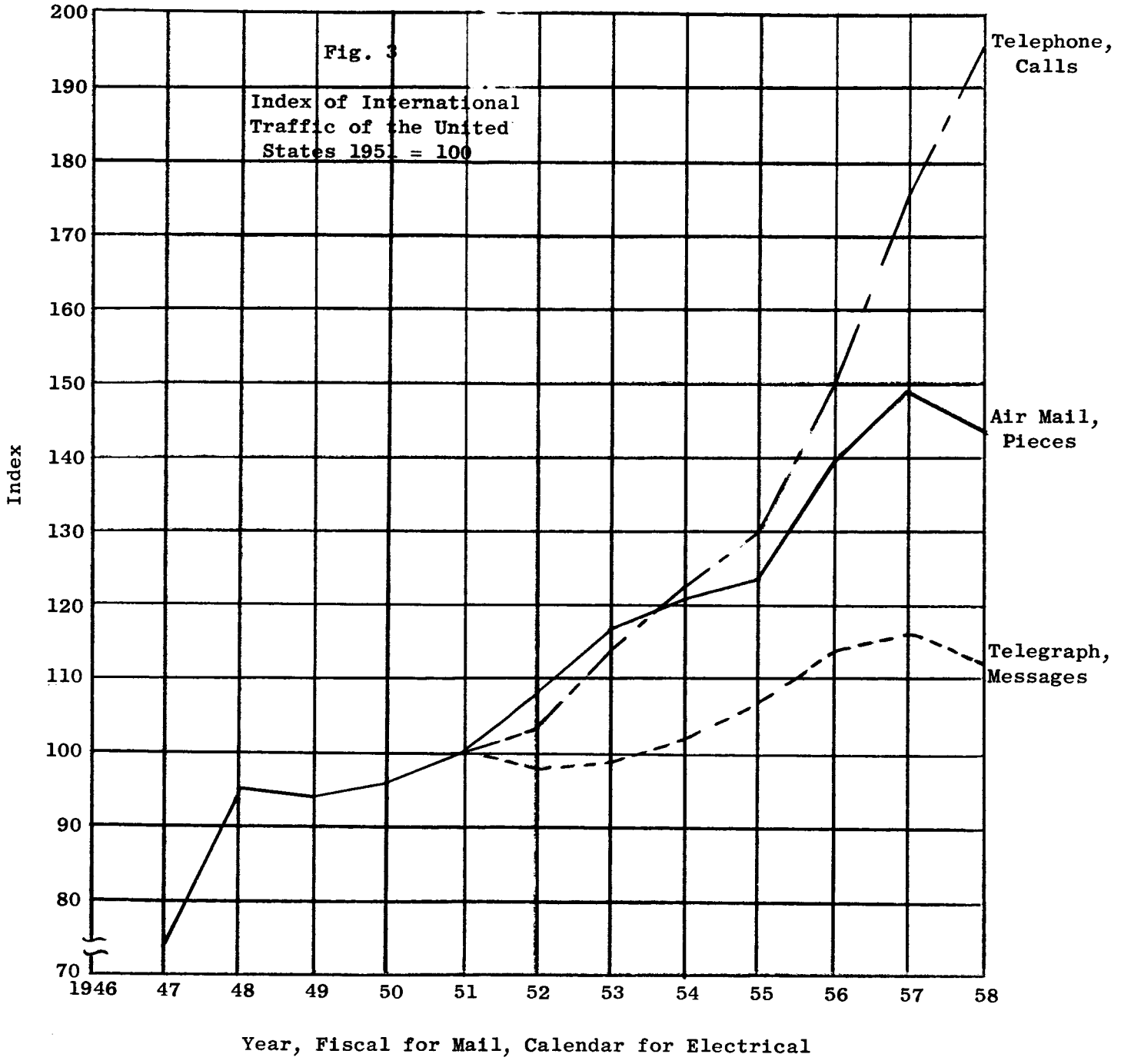


Fig. 3
Index of International Traffic of the United States 1951 = 100
Telephone, Calls
Air Mail, Pieces
Telegraph, Messages
Index
200
190
180
170
160
150
140
130
120
110
100
90
80
70
1946
47
48
49
50
51
52
53
54
55
56
57
58
Year, Fiscal for Mail, Calendar for Electrical

Fig. 4

Annual International Telegraph Message Traffic of the United States of Various Message Types

Source: Statistics of Communications Common Carrier, FCC

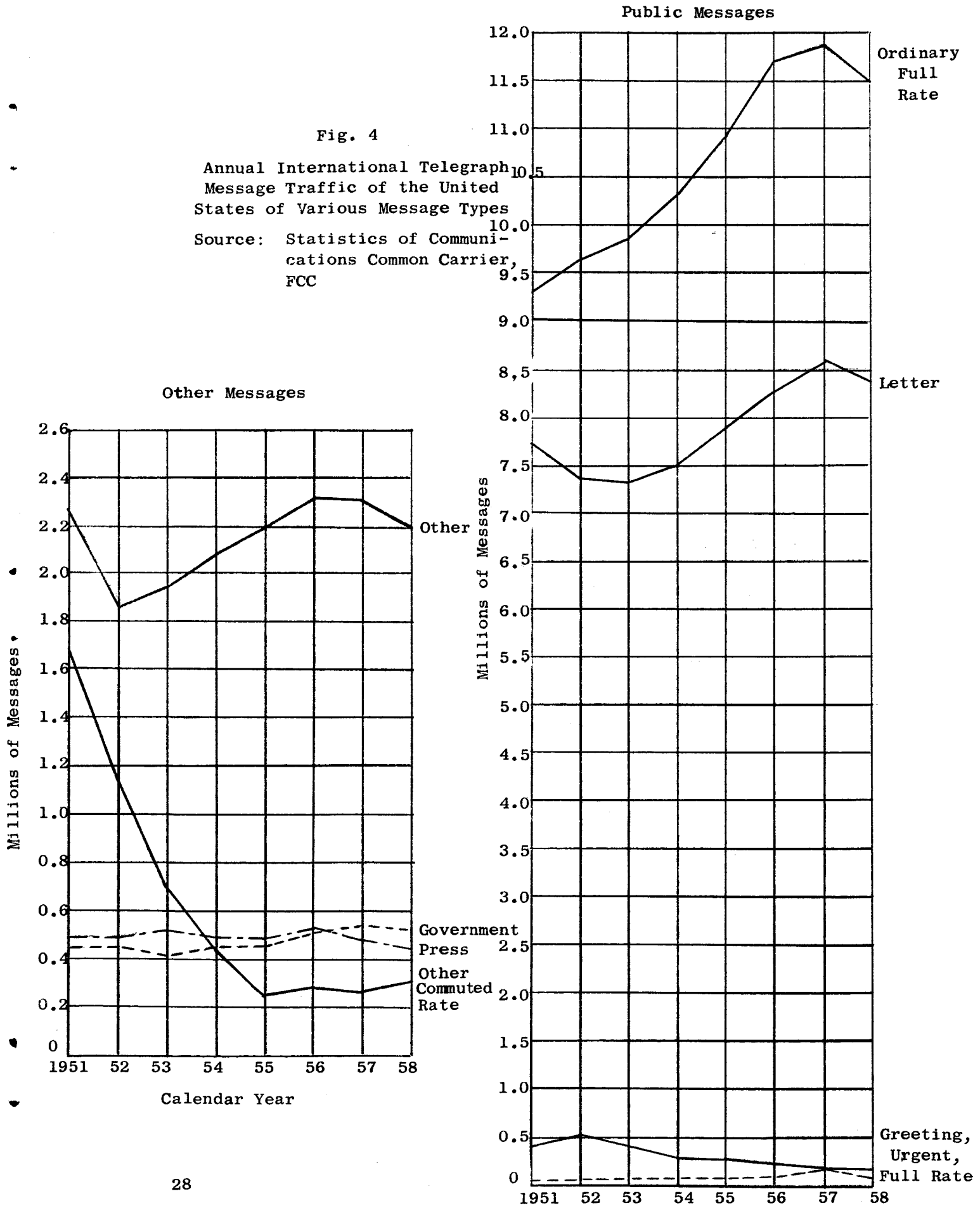
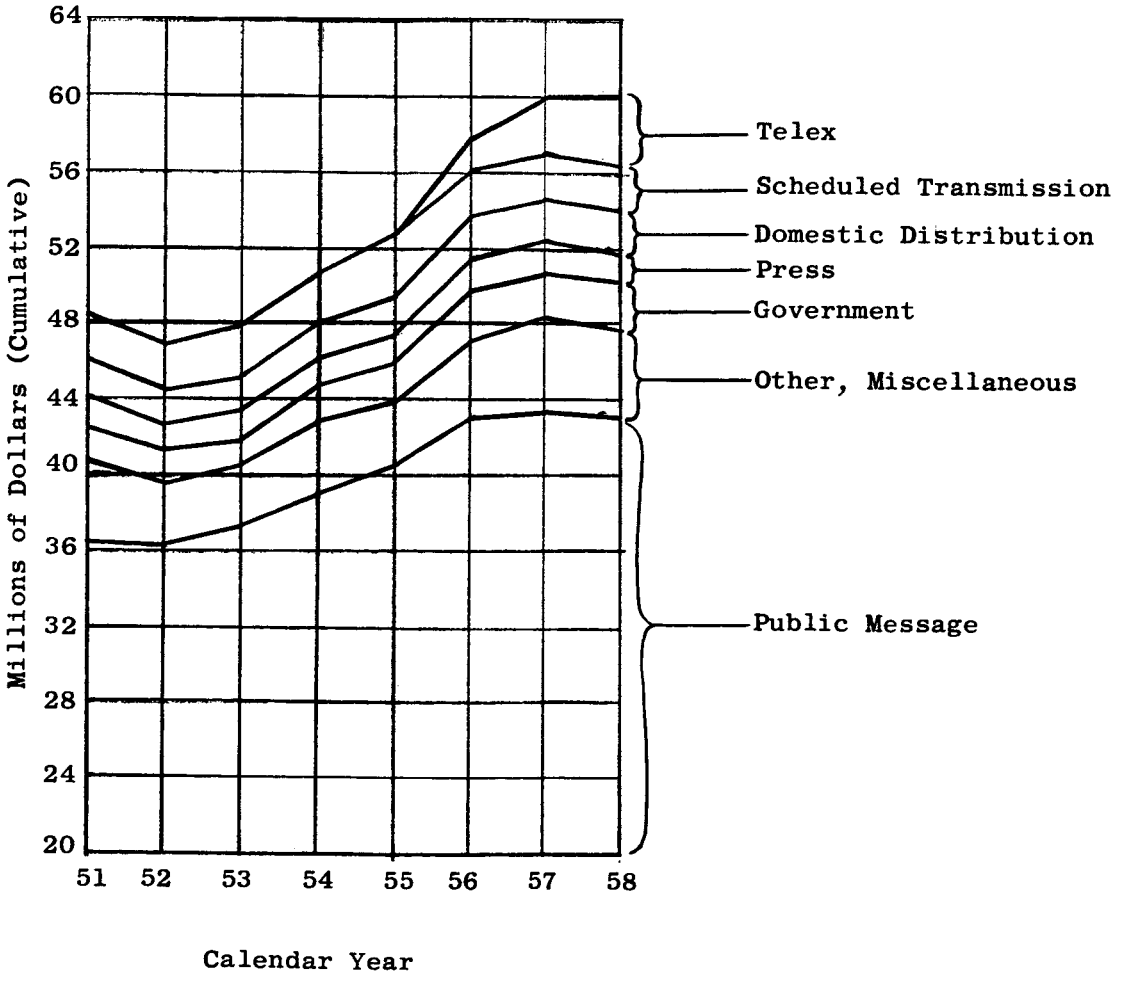


Fig. 5(a)

Cumulative International Telegraph
Revenue from Selected Services

Source: Statistics of Communications
Common Carriers, FCC



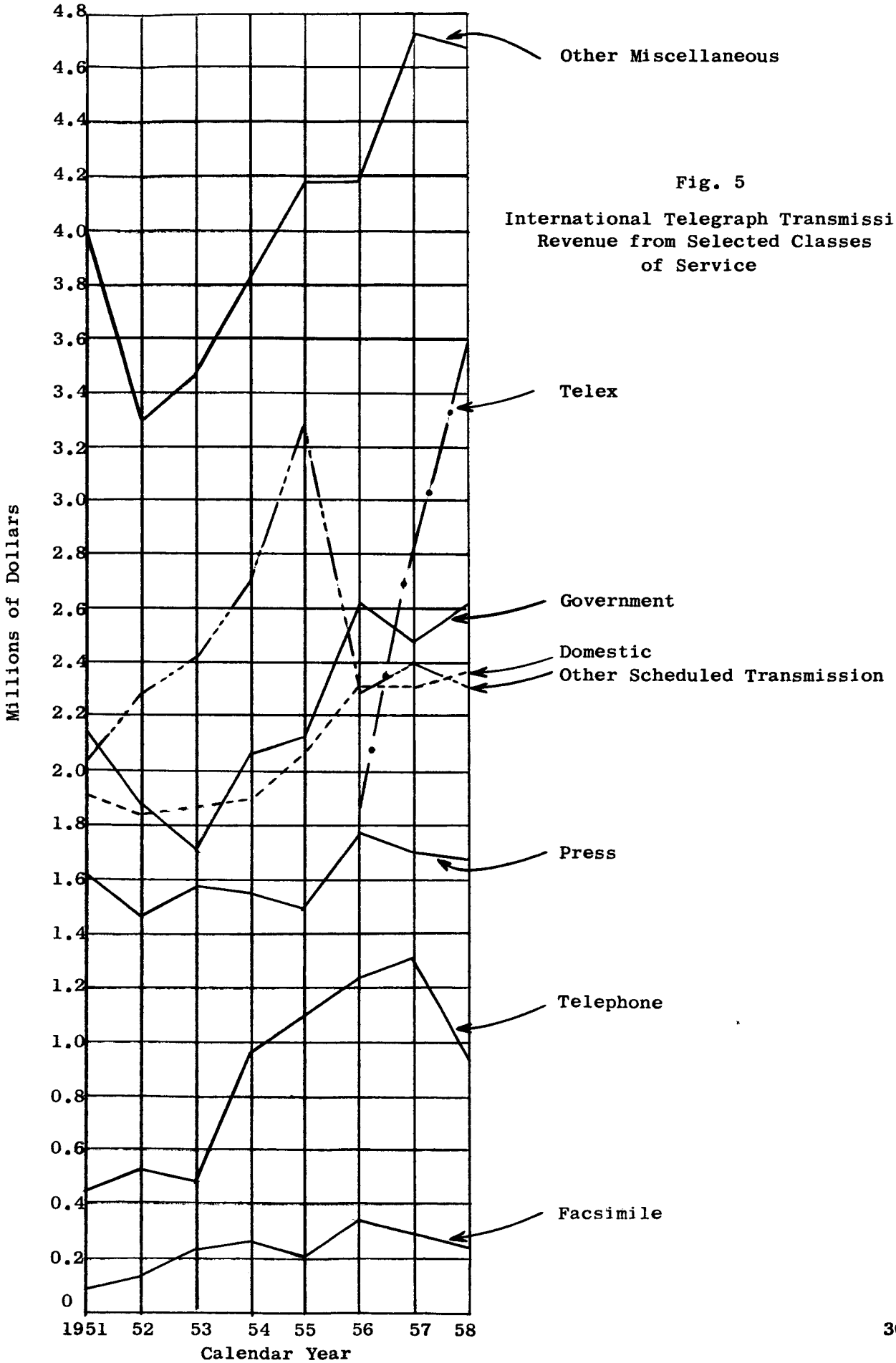


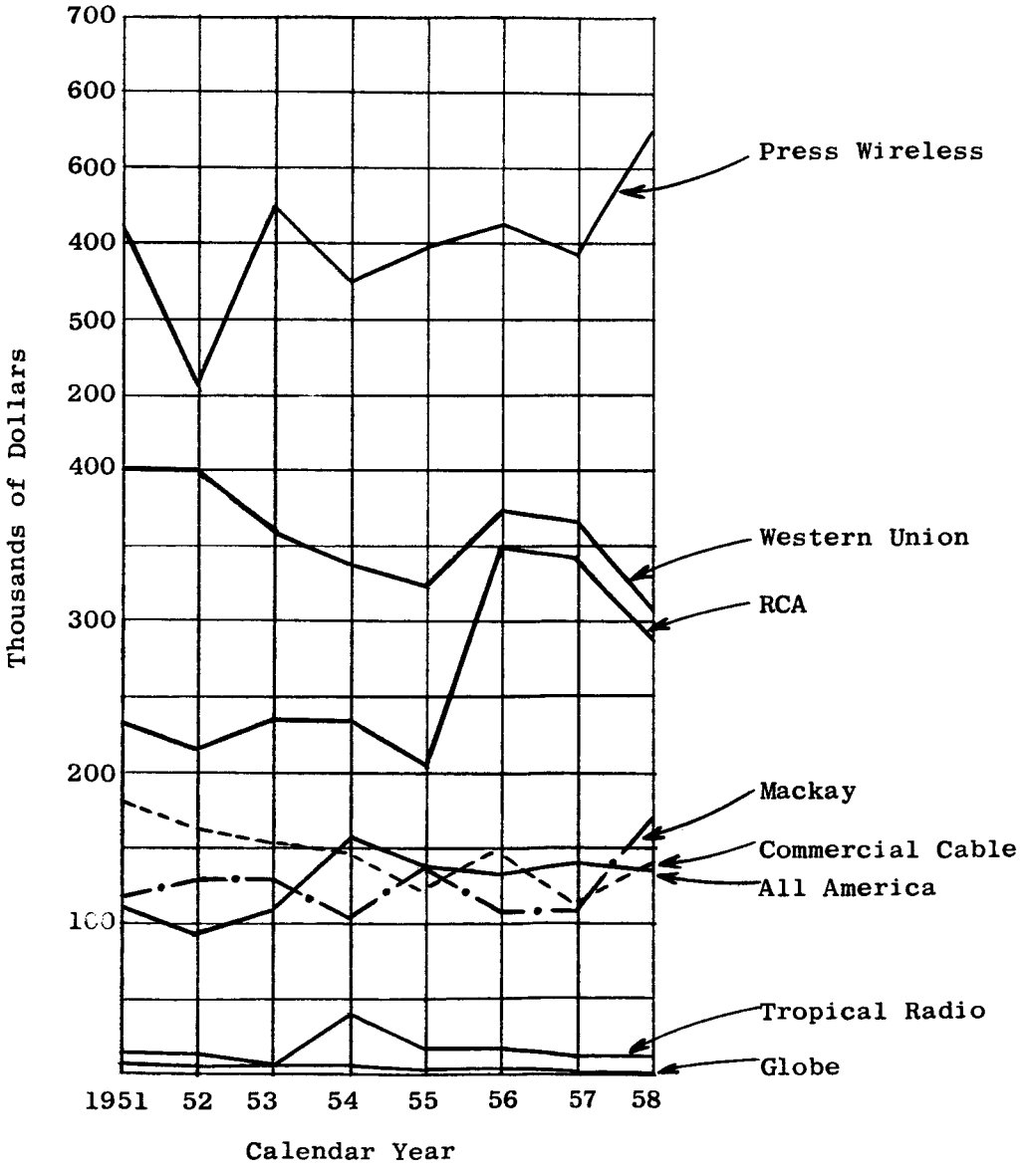
Fig. 5

International Telegraph Transmission
Revenue from Selected Classes
of Service

Fig. 5(c)

International Telegraph Transmission
Revenue from Press Messages

Source: Statistics of Communications
Common Carriers



TOTAL

ANNUAL OPERATING REVENUES OF U.S. TELEGRAPH COMMON CARRIERS

SOURCE: STATISTICS OF COMMUNICATIONS COMMON CARRIERS, FCC

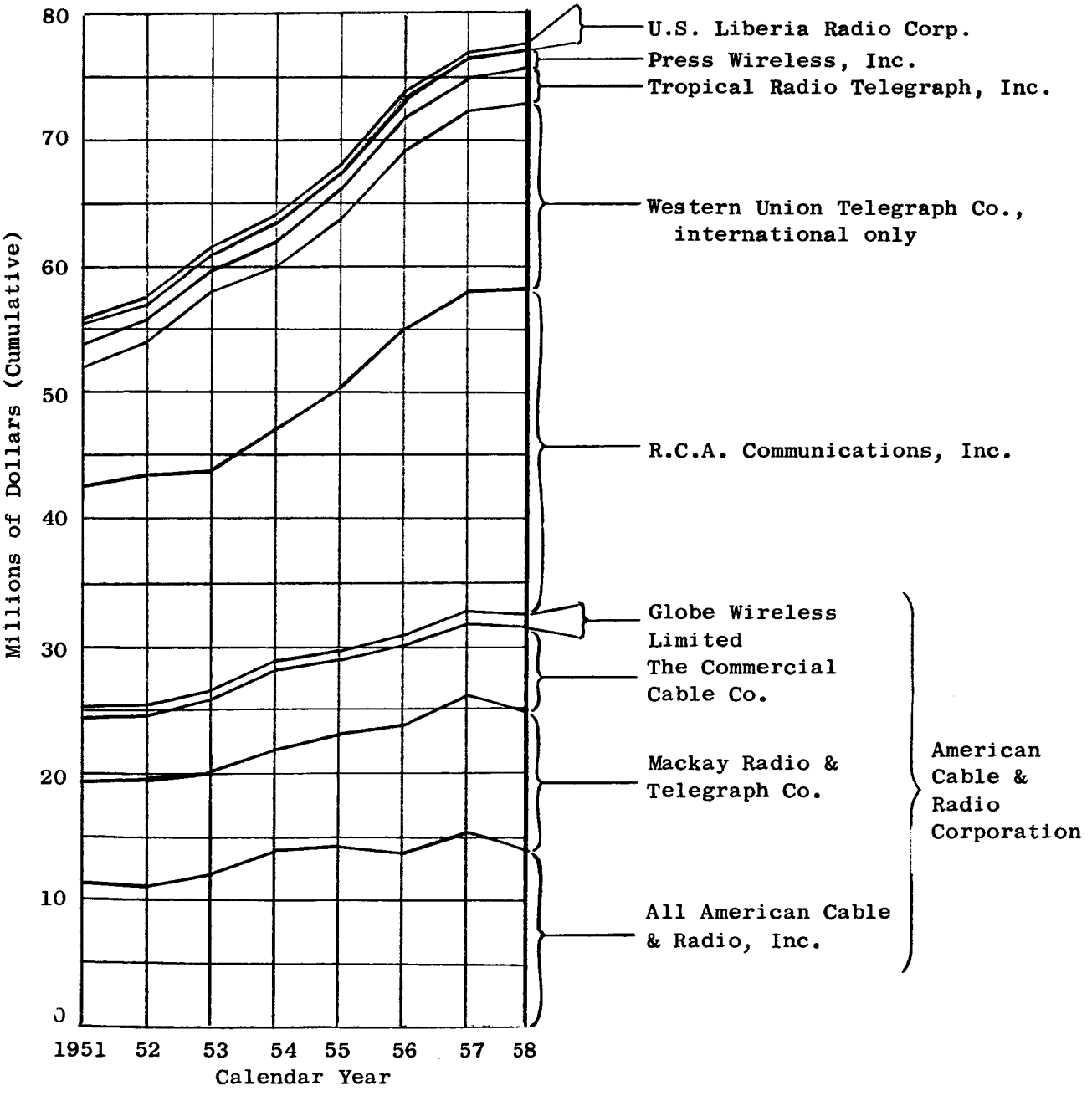


Fig. 6